

*Fiber Glass Systems*  
**CERAM CORE®**  
**Abrasion Resistant Piping for  
Power Generation Applications**



**NOV** Fiber Glass Systems™

STAR • SMITH • FIBERCAST

# CERAM CORE PIPING SYSTEM

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## *Long Lasting*

## *Abrasion Resistant*

## *Lightweight*

- Outlasts carbon steel, cast iron and special alloys under equal conditions.
- Installs easily. Lightweight CERAM CORE piping is easy to handle. Installs quickly with less manpower.
- Reduces equipment requirements. CERAM CORE piping is one-tenth the weight of basalt-lined steel.
- Requires low maintenance. Reduced wear means longer time before rotation of the pipe. Rotations are easier, faster and more economical because of the lightweight 30-foot lengths of CERAM CORE pipe.
- Resists internal and external corrosion.

CERAM CORE is a fiberglass reinforced epoxy resin pipe with a special abrasion resistant liner composed of small spherical beads of high alumina ceramic, held in an epoxy matrix. Because of its unique combination of ceramic beads and epoxy resin, CERAM CORE pipe also exhibits excellent corrosion resistance.

A major breakthrough in abrasion resistance in pipe has been achieved with this concept. CERAM CORE pipe development dates from 1970 and volume production from 1976. It consistently shows outstanding wear resistance properties in a variety of installations.

CERAM CORE piping is specifically designed for the severe abrasion conditions caused by sharp angular particles in high flow streams. Most noticeable is its successful service in handling bottom ash

(see "Field Tests"). Other typical services are sand lines, fly ash lines and mine tailings.

CERAM CORE pipe is outlasting and out performing steel, special alloys, and other lined pipe at competitive costs. Its light weight and easy handling offer savings in man hours and equipment in initial installations and long-term maintenance.

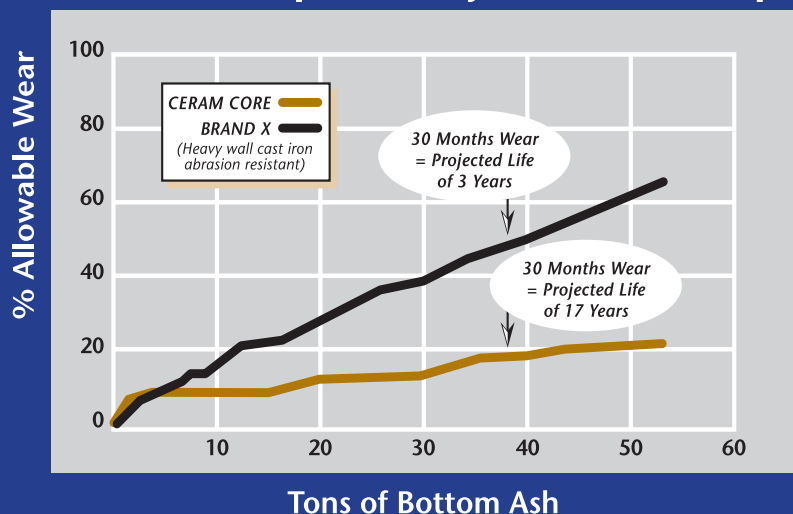
### *Available in Various Sizes and Fittings*

CERAM CORE pipe is offered in 6"-16" diameters in standard 30 foot (9.14 meters) lengths ( $\pm 1/8$  inch), for slurry abrasion service up to 200°F (93°C). The system includes 45° and 90° elbows with a 3-diameter sweep radius. Special angle fittings, including laterals, are available on request.



## SIGNIFICANT FIELD TESTS

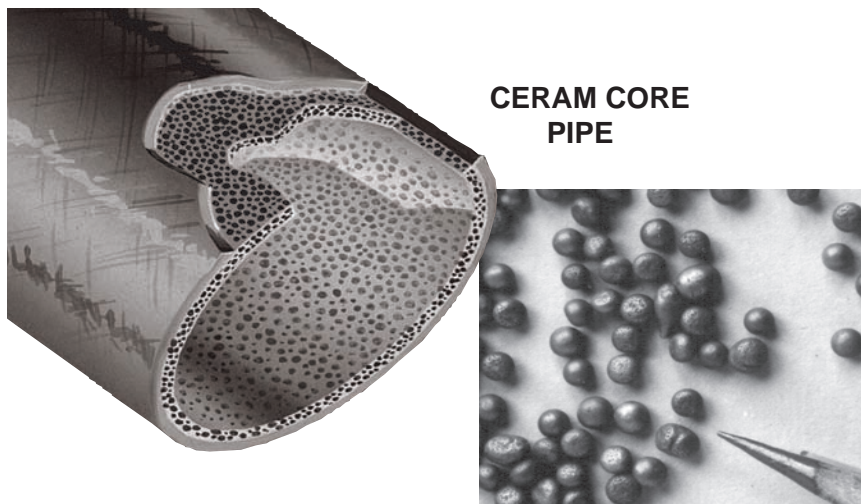
### CERAM CORE Pipe vs. Heavy Wall Cast Iron Pipe



An Idaho mine installed a CERAM CORE test spool in a zinc slurry to compare it to Schedule 80 steel. Normal life for the steel was one month. After 21 months, the CERAM CORE spool was still in service.

A CERAM CORE test spool was installed in a Wisconsin taconite operation. Carbon steel in this application lasted from 6 to 12 months without rotation. After 19 months without rotation, the CERAM CORE spool showed little wear.

A 10-inch diameter, 18-foot CERAM CORE test spool was installed in bottom ash service at a major power station in Georgia. Similar test spools of other types of pipe including heavy wall abrasion resistant cast iron were also installed. After 30 months handling 53,000 tons of ash, the CERAM CORE test spool showed a projected continuing wear life of over 17 years versus 3 years for the metallic pipe (see graph). This utility since expanded CERAM CORE pipe use, in 8"-12" diameters, to more than 6 miles at five separate plants.



CERAM CORE PIPE

The liner of CERAM CORE pipe is composed of small, high alumina ceramic beads held in an epoxy matrix. This liner is resistant to corrosion and abrasion caused by angular particles.

### ABRASIVE APPLICATIONS

- Bottom Ash
- Wet Fly Ash
- Vanadium Ore Slurries
- Zinc Tailings
- Taconite Tailings
- Heavy Salt Slurries
- Dredge Lines
- Smelter Slags
- Wet Process Slurries
- Copper Tailings
- Iron Ore Tailings
- Dust Collection
- Diatomaceous Earth
- Potash Tailings
- Uranium Ore Slurries
- Concrete Slurries
- Wood Pulp Slurries

# CERAM CORE PIPING SYSTEM

## Abrasion Resistant Piping Systems Comparison

| Property                                 | CERAM CORE Pipe  |     |      | Basalt Pipe         |     |     | High Chromium Cast Iron Pipe                 |       |       |
|--|--|-----|------|---------------------|-----|-----|--|-------|-------|
|  | 8"   | 10" | 12"  | 8"                  | 10" | 12" | 8"   | 10"   | 12"   |
| I.D. Hardness                            | Brinell - Exceeds 615<br>MOD - 9<br>Rockwell - R45N - 79 |     |      | -<br>MOH - 7.8<br>- |     |     | Brinell - 300-500<br>-<br>Rockwell - C-34-57 |       |       |
| Flow Factor (Hazen-Williams Coefficient) | 130  |     |      | 100                 |     |     | 100  |       |       |
| <sup>(1)</sup> Weight Per Foot (Lbs.)    | 7.2  | 9.8 | 12.8 | 58                  | 70  | 83  | 55   | 60-70 | 75-93 |
| Standard Length (Ft.)                    | 30   |     |      | 18                  |     |     | 18   |       |       |
| Weight Per Length (Lbs.)                 | 294 <sup>(1)</sup>                                       |     |      | 1,260               |     |     | 1,170  |       |       |
| Typical Fitting Weight 90° Elbow (Lbs.)  | 75   | 125 | 190  | 326                 | 398 | 462 | 465  | 760   | 1,130 |

<sup>(1)</sup>Weight per 30-foot length of CERAM CORE pipe includes two flanges.



## Installation Time Comparison

### CERAM CORE Piping vs. High Chromium Cast Iron Piping

|   |   |
|---|---|
| Submitted by:                           | A Midwestern electric cooperative.  |
|   |   |
| Pipe Size and Type:                     | 12" CERAM CORE Pipe and 12" high chrome cast iron pipe                                    |
|   |   |
| Straight Runs of Pipe Inside Building:  | CERAM Core pipe took one-third as long as cast iron pipe to install.                      |
|   |   |
| Fittings Inside Building:               | CERAM CORE fittings took one-fourth to one-half as long as cast iron fittings to install. |
|   |   |
| Straight Runs of Pipe Outside Building: | CERAM CORE pipe took one-half as long as cast iron pipe to install.                       |

NOTE: This example does not include equipment savings to handle the two products.

### LABOR ESTIMATE EXAMPLE (Inside Building)

#### PIPE

| Type of Pipe   | Estimated Man hours/Ft. of Pipe Installed | Total Estimated Man hours to Install 6,000 ft. of Pipe |
|----------------|---|--|
| 10" CERAM CORE | 0.252                                     | 1,512  |
| 10" Cast Iron  | 0.810                                     | 4,860  |
| 10" Basalt     | 1.140                                     | 6,840  |

#### FITTINGS

| Type of Pipe                            | Type of Fitting |           |         |
|---|-----------------|-----------|---------|
|   | 90° Elbow       | 45° Elbow | Lateral |
| (Estimated Man hours/Fitting Installed) |                 |           |         |
| 10" CERAM CORE                          | 3.39            | 3.26      | 5.89    |
| 10" Cast Iron                           | 7.87            | 7.37      | 10.80   |
| 10" Basalt                              | 10.23           | 9.58      | 14.04   |

# CERAM CORE PIPING SYSTEM

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## CERAM CORE Joining Methods

Proper joining procedures are extremely important to obtain the maximum service life from CERAM CORE pipe.

CERAM CORE pipe flanges have been designed to align and seal properly when installed as directed. Particular attention must be given to accurately align pipe I.D.'s at all joints. Proper installation prevents undercutting of the lining and protects the piping system from premature wear.

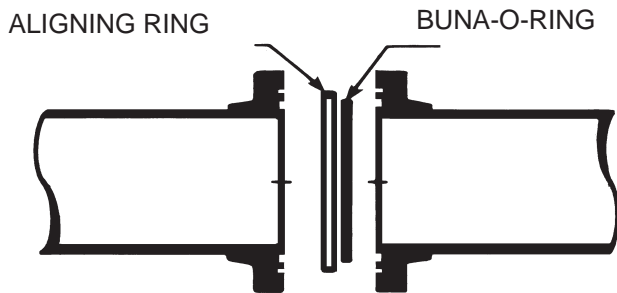
CERAM CORE pipe can be installed in a new or existing systems. Since dimensions vary with the application, Fiber Glass Systems will design transition fittings as needed for each installation upon receipt of necessary dimensional information.

More detailed information on proper handling and installation is available in Manual No. 6460.



Specially designed CERAM CORE flanges make it easy to properly align pipe and fittings when installing to new or existing systems.

## Self-Aligning Flanges



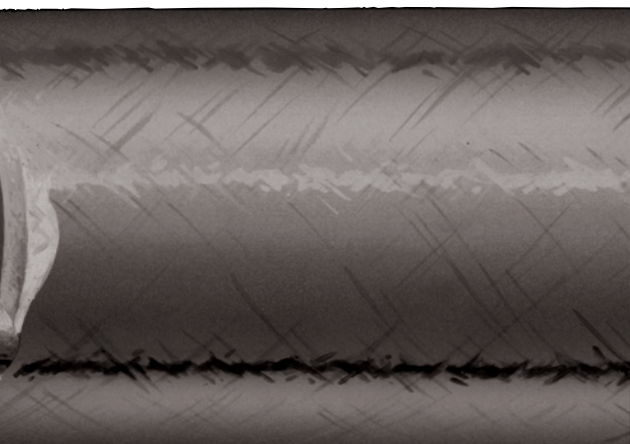
Self-aligning flanges are used on CERAM CORE pipe and fittings to assure the inside diameters of the liners are properly aligned.

One filament wound epoxy resin aligning ring and one Buna™ N O-ring, supplied by Fiber Glass Systems, is used on each joint. See CERAM CORE pipe installation instructions, Manual No. F6460.

<sup>TM</sup>Buna is a trademark of DuPont.



Its comparative light weight makes CERAM CORE pipe ideal for above ground applications



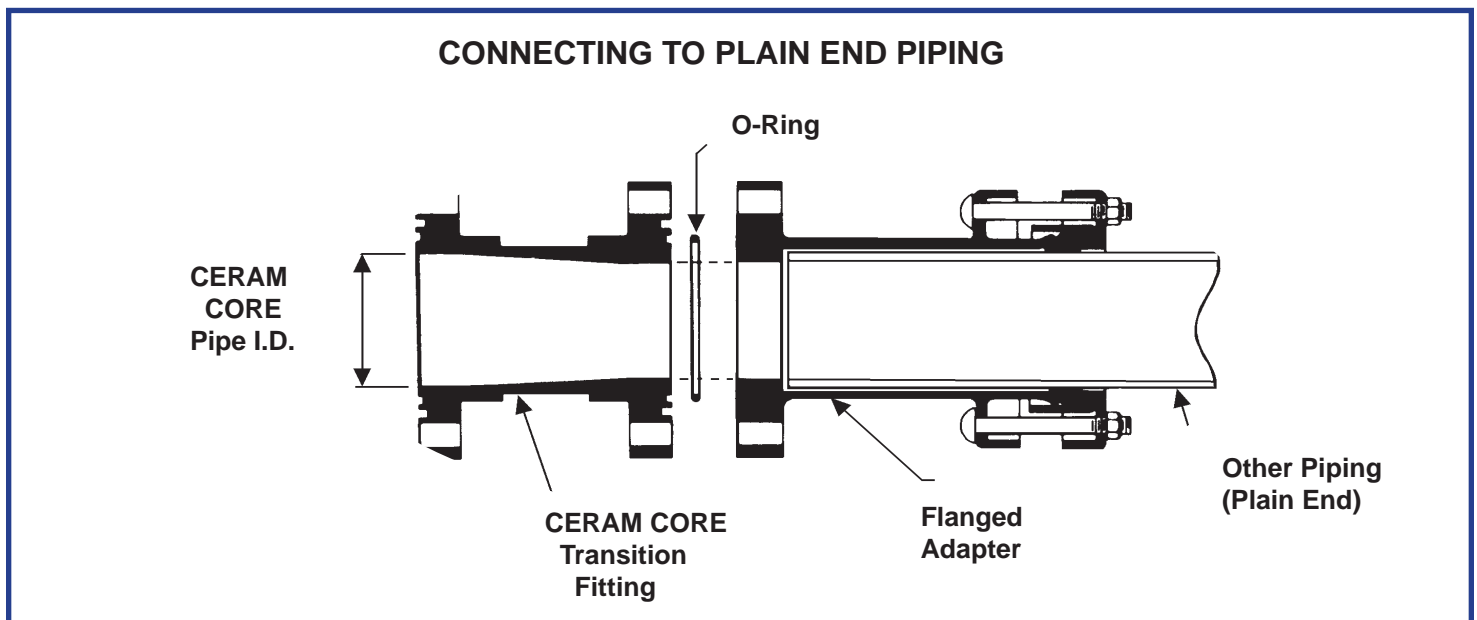
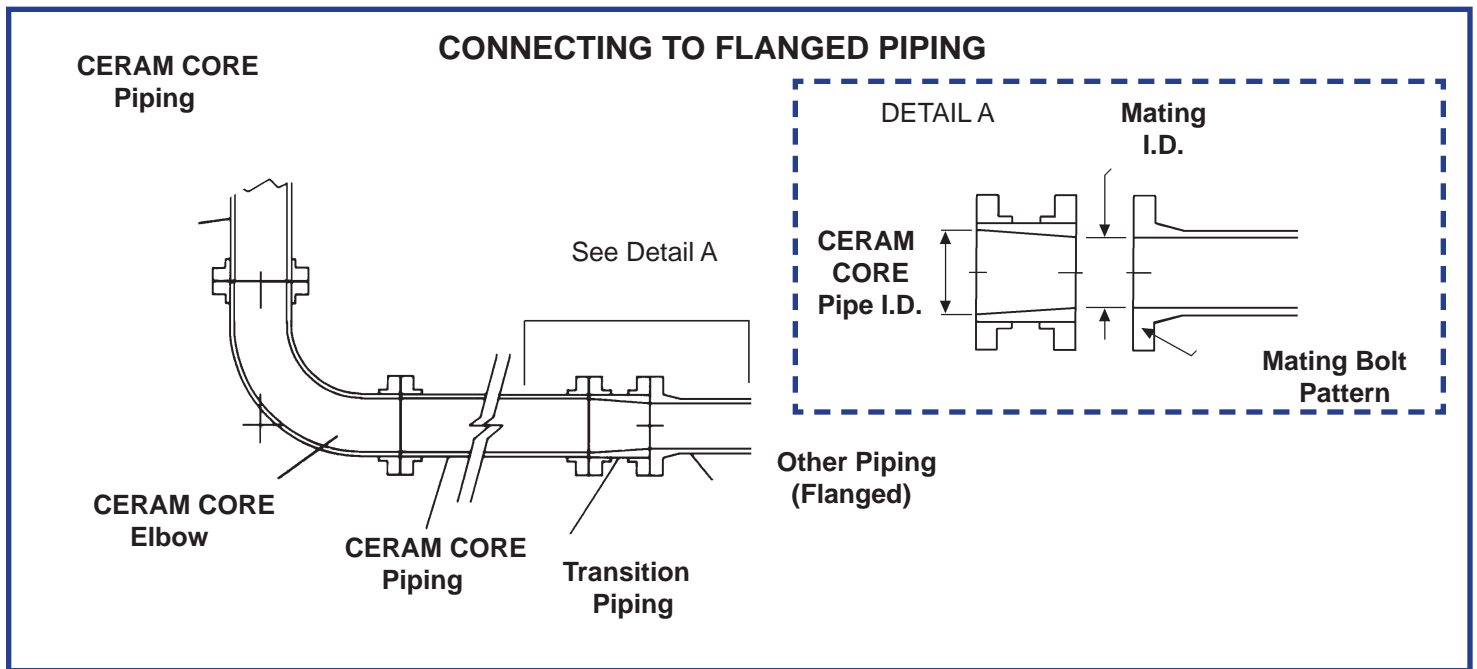
Forty-five degree sweep elbows lined with high alumina ceramic tiles are one of the fittings choices you have when designing a complete CERAM CORE piping system.

# CERAM CORE PIPING SYSTEM

## Transition Fittings

Transition fittings are necessary to join CERAM CORE pipe to systems with different inside diameters. It is essential that inside diameters of pipe-to-pipe and pipe-to-fittings be exactly matched. Mismatched I.D.'s can cause liners to be undercut and scooped away, causing premature failure.

Two flanged transition fittings generally will be required for each application. A typical concentric reducer transition fitting is shown that will join another type of flanged system having an inside diameter "XX" to a CERAM CORE system having an inside diameter "CC."





## Fittings Information

CERAM CORE abrasion resistant fittings 6 through 16 inch diameters are available in a variety of configurations - 45° elbows and 90° elbows<sup>(1)</sup>, 45° laterals, flanges and 11¼°, 15°, 22½°, 30°, and 60° elbows, are standard parts. Other odd degree elbows are available on request.

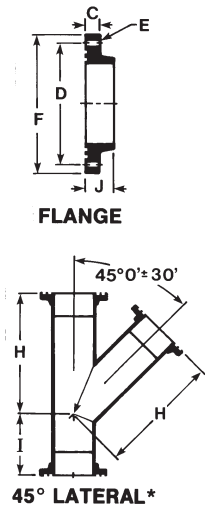
All fittings have liners composed of tiles similar in composition to the alumina ceramic beads used in the liner of CERAM CORE pipe. Fittings are designed to resist high turbulence and high impact.

CERAM CORE fittings have thermosetting resin and fiberglass reinforcement for physical strength. Self-aligning flanges are utilized on all fittings.<sup>(2)</sup>

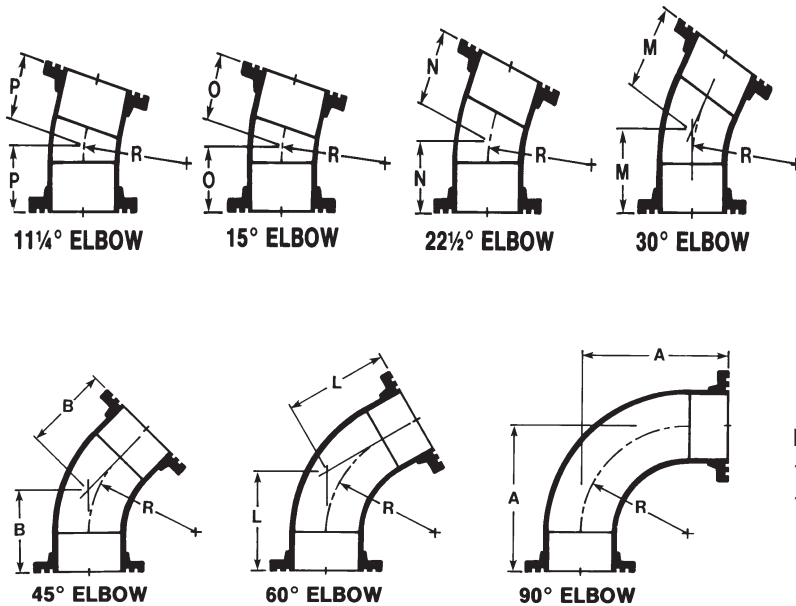
CERAM CORE sweep elbows have a center line radius of three times the nominal diameter (see dimension R in table).

<sup>(1)</sup>14" and 16" sweep elbows available in 45° or less only.

<sup>(2)</sup> See Fiber Glass Systems Manual No. 6460 for bolt torque recommendations.



See page 10 for dimensions



NOTE: 6"-12" laterals pressure rated at 100 psig; 14" and 16" rated at 80 psig. Do not pressurize over 1½ times the maximum operating pressure.

# CERAM CORE PIPING SYSTEM

## GENERAL PIPE SPECIFICATIONS

| Nominal Pipe Size | Nominal O.D. | Nominal I.D. | Nominal Total Wall Thickness | Nominal Liner Thickness | Min. Bending Radius<br>75°F(24°C) | Maximum Operating Pressure | Max. Operating Temperature*<br>Hydraulic Service | Nominal Weight |
|-------------------|--------------|--------------|------------------------------|-------------------------|-----------------------------------|----------------------------|--|----------------|
| In.               | In.          | In.          | In.                          | In.                     | Ft.                               | psig                       | °F   | Lbs./Ft.       |
| 6                 | 6.700        | 6.125        | .288                         | .130                    | 240                               | 225                        | 200  | 5.6            |
| 8                 | 8.710        | 8.095        | .308                         | .130                    | 310                               | 225                        | 200  | 7.8            |
| 10                | 10.780       | 10.160       | .310                         | .130                    | 390                               | 225                        | 200  | 9.8            |
| 12                | 12.980       | 12.300       | .340                         | .130                    | 460                               | 225                        | 200  | 12.8           |
| 14                | 14.745       | 14.020       | .363                         | .130                    | 530                               | 100                        | 200  | 15.4           |
| 16                | 16.800       | 16.020       | .390                         | .130                    | 600                               | 100                        | 200  | 18.8           |

| Nominal Pipe Size | Nominal O.D. | Nominal I.D. | Nominal Total Wall Thickness | Nominal Liner Thickness | Min. Bending Radius<br>75°F(24°C) | Maximum Operating Pressure | Max. Operating Temperature*<br>Hydraulic Service | Nominal Weight |
|-------------------|--------------|--------------|------------------------------|-------------------------|-----------------------------------|----------------------------|--|----------------|
| mm                | mm           | mm           | mm                           | mm                      | m                                 | MPa                        | °C   | kg/m           |
| 150               | 170.18       | 155.58       | 7.32                         | 3.30                    | 73.2                              | 1.55                       | 93   | 8.33           |
| 200               | 221.23       | 205.61       | 7.82                         | 3.30                    | 94.5                              | 1.55                       | 93   | 11.60          |
| 250               | 273.81       | 258.06       | 7.87                         | 3.30                    | 119.0                             | 1.55                       | 93   | 14.60          |
| 300               | 329.69       | 312.42       | 8.64                         | 3.30                    | 140.2                             | 1.55                       | 93   | 19.00          |
| 350               | 374.52       | 356.11       | 9.22                         | 3.30                    | 162.0                             | 0.69                       | 93   | 22.90          |
| 400               | 426.72       | 406.91       | 9.91                         | 3.30                    | 183.0                             | 0.69                       | 93   | 28.00          |

## GENERAL FITTINGS DIMENSIONS (Drawings on page 9)

| Nominal Pipe Size | A                              | B                              | C                             | D                              | E  | F                              | H   | I   | J                             | L                              | M                              | N                              | O                              | P                              | R   |
|-------------------|--------------------------------|--------------------------------|-------------------------------|--------------------------------|--|--------------------------------|-----|-----|-------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|-----|
| In.               | In.                            | In.                            | In.                           | In.                            | In.  | In.                            | In. | In. | In.                           | In.                            | In.                            | In.                            | In.                            | In.                            | In. |
| 6                 | 23 <sup>1</sup> / <sub>2</sub> | 12 <sup>7</sup> / <sub>8</sub> | 1 <sup>1</sup> / <sub>2</sub> | 9 <sup>1</sup> / <sub>2</sub>  | <sup>7</sup> / <sub>8</sub> D-8 Holes      | 11                             | 18  | 9   | 3                             | 15 <sup>7</sup> / <sub>8</sub> | 10 <sup>1</sup> / <sub>4</sub> | 9                              | 7 <sup>7</sup> / <sub>8</sub>  | 7 <sup>1</sup> / <sub>4</sub>  | 18  |
| 8                 | 30 <sup>1</sup> / <sub>2</sub> | 16 <sup>3</sup> / <sub>8</sub> | 1 <sup>3</sup> / <sub>4</sub> | 11 <sup>1</sup> / <sub>2</sub> | <sup>7</sup> / <sub>8</sub> D-8 Holes      | 13 <sup>1</sup> / <sub>2</sub> | 22  | 11  | 4                             | 20 <sup>3</sup> / <sub>8</sub> | 12 <sup>7</sup> / <sub>8</sub> | 11 <sup>1</sup> / <sub>4</sub> | 9 <sup>5</sup> / <sub>8</sub>  | 8 <sup>7</sup> / <sub>8</sub>  | 24  |
| 10                | 37 <sup>3</sup> / <sub>4</sub> | 20 <sup>1</sup> / <sub>8</sub> | 2                             | 14 <sup>1</sup> / <sub>4</sub> | 1 D - 12 Holes                             | 16                             | 28  | 14  | 4 <sup>3</sup> / <sub>4</sub> | 25                             | 15                             | 13                             | 11 <sup>5</sup> / <sub>8</sub> | 10 <sup>5</sup> / <sub>8</sub> | 30  |
| 12                | 44 <sup>5</sup> / <sub>8</sub> | 23 <sup>1</sup> / <sub>2</sub> | 2 <sup>1</sup> / <sub>4</sub> | 17                             | 1 D - 12 Holes                             | 19                             | 30  | 16  | 5                             | 29 <sup>3</sup> / <sub>8</sub> | 18 <sup>1</sup> / <sub>4</sub> | 15                             | 13                             | 12 <sup>1</sup> / <sub>8</sub> | 36  |
| 14                | -                              | 22 <sup>7</sup> / <sub>8</sub> | 2 <sup>1</sup> / <sub>2</sub> | 18 <sup>3</sup> / <sub>4</sub> | 1 <sup>1</sup> / <sub>8</sub> D - 12 Holes | 20 <sup>3</sup> / <sub>4</sub> | 36  | 18  | 3 <sup>1</sup> / <sub>8</sub> | -                              | 16                             | 13 <sup>7</sup> / <sub>8</sub> | 11                             | 9 <sup>5</sup> / <sub>8</sub>  | 42  |
| 16                | -                              | 27 <sup>1</sup> / <sub>8</sub> | 2 <sup>1</sup> / <sub>2</sub> | 21 <sup>1</sup> / <sub>4</sub> | 1 <sup>1</sup> / <sub>8</sub> D - 16 Holes | 23 <sup>1</sup> / <sub>4</sub> | 42  | 21  | 3 <sup>1</sup> / <sub>8</sub> | -                              | 20 <sup>1</sup> / <sub>8</sub> | 16                             | 13                             | 12                             | 48  |

| Nominal Pipe Size | A    | B   | C  | D   | E               | F   | H    | I   | J   | L   | M   | N   | O   | P   | R    |
|-------------------|------|-----|----|-----|-----------------|-----|------|-----|-----|-----|-----|-----|-----|-----|------|
| mm                | mm   | mm  | mm | mm  | mm              | mm  | mm   | mm  | mm  | mm  | mm  | mm  | mm  | mm  | mm   |
| 150               | 597  | 329 | 38 | 241 | 22 D - 8 Holes  | 279 | 457  | 229 | 76  | 404 | 262 | 230 | 200 | 184 | 457  |
| 200               | 775  | 418 | 44 | 298 | 22 D - 8 Holes  | 349 | 559  | 279 | 102 | 517 | 328 | 287 | 246 | 225 | 610  |
| 250               | 959  | 513 | 51 | 362 | 25 D - 12 Holes | 406 | 711  | 356 | 121 | 637 | 402 | 349 | 297 | 271 | 762  |
| 300               | 1113 | 598 | 57 | 432 | 25 D - 12 Holes | 483 | 813  | 406 | 127 | 747 | 465 | 402 | 340 | 310 | 914  |
| 350               | -    | 581 | 64 | 476 | 29 D - 12 Holes | 527 | 914  | 457 | 79  | -   | 425 | 352 | 279 | 244 | 1067 |
| 400               | -    | 689 | 64 | 540 | 29 D - 16 Holes | 591 | 1067 | 533 | 79  | -   | 511 | 427 | 345 | 305 | 1219 |

\*Consult Fiber Glass Systems concerning all pneumatic applications with CERAM CORE pipe or any type of application exceeding 200°F (93°C).

Tolerances or maximum/minimum limits can be obtained from Fiber Glass Systems.

For corrosion resistance data in liquid systems, refer to Fiber Glass Systems Bulletin No. E5615 and use data for GREEN THREAD® Product.

# CERAM CORE PIPING SYSTEM

## Suggested Specification

### Application

Hydraulic conveying of bottom ash (with or without pyrites), mine tailings, fly ash, or other abrasive slurries.

### System Pressure Rating

6" - 12" 225 psig at 200°F

14" - 16" 100 psig at 200°F

### Pipe

Pipe shall have a minimum pressure rating of 225 psig at 200°F for 6"-12" and 100 psig for 200°F for 14" and 16" diameters. Pipe shall be manufactured by the filament winding process using thermosetting epoxy resin to impregnate strands of continuous glass filaments which are wound at a 54<sup>1</sup>/<sub>4</sub>° wind angle, under controlled tension over a liner consisting of a spherical beads of high alumina ceramic in a matrix of epoxy resin. CERAM CORE pipe manufactured by Fiber Glass Systems, or engineer approved equal.

### Material Standard

**Pipe** - Pipe shall have a minimum pressure rating of 225 psig at 200°F for 6"-12" and 100 psig at 200°F for 14" and 16" diameters. Pipe shall be filament wound over 0.130" thick liner composed of spherical beads of high alumina ceramic held in a matrix of epoxy resin.

ASTM D-2310 - RTRP 11CF

**Fittings** - Abrasion resistant 45 and 90 degree elbows shall be three diameter sweep radius and have self-aligning flanged ends. They shall be glass reinforced thermosetting resin with abrasion resistant ceramic tile liner

**Joints** - All pipe and fittings shall be supplied with self-aligning flanges. Flanges shall be supplied with an alignment ring and o-ring groove. Flanges shall be drilled according to ANSI B16.5, 150 lb. bolt hole circle. It is recommended that a protective coating be used on the bolts to facilitate removal for rotation.

**Gaskets** - Gaskets shall be o-ring, 60-70 durometer. Gaskets for the self-aligning flange joints will be supplied by Fiber Glass Systems.

### Field Installation Assistance

Installing contractor shall coordinate with pipe manufacturer initial installation assistance and field pipe fabrication procedures. Additional assistance should be coordinated as required.

### Field Testing

The recommended procedure is to test the system at 1<sup>1</sup>/<sub>2</sub> times the anticipated operating pressure. The test pressure should never exceed 1<sup>1</sup>/<sub>2</sub> times the maximum rated operating pressure for the lowest rated element in the system. The pressure is maintained on the system to allow sufficient time to inspect the system for leakage.

All joints shall be exposed for visual inspection until hydrostatic test is completed and system accepted.

| Typical Physical Properties             | Value @ 75° F / 24° C   |        | Value @ 200° F / 93° C |       |
|---|---|--------|------------------------|-------|
|   | psi   | MPa    | psi                    | MPa   |
| Axial Tensile - ASTM D2105              |   |        |                        |       |
| Ultimate Stress                         | 10,300  | 71     | 7,740                  | 53.4  |
| Modulus Elasticity                      | 1.82 x 10 <sup>6</sup>  | 12,548 | 1.42 x 10 <sup>6</sup> | 9,791 |
| Axial Compression - ASTM D695           |   |        |                        |       |
| Ultimate Stress                         | 33,300  | 230    | 20,400                 | 141   |
| Modulus of Elasticity                   | 1.26 x 10 <sup>6</sup>  | 8,687  | 0.65 x 10 <sup>6</sup> | 4,470 |
| Coefficient of Linear Thermal Expansion | 0.88 x 10 <sup>-5</sup> in/in/°F • 1.58 x 10 <sup>-5</sup> mm/mm/°C |        |                        |       |

| Size | Thermal End Loads and Guide Spacing |                   |               |                   |               |                   |               |                   |
|------|-------------------------------------|-------------------|---------------|-------------------|---------------|-------------------|---------------|-------------------|
|      | 125°F                               |                   | 150°F         |                   | 175°F         |                   | 200°F         |                   |
|      | Guide Spacing                       | Thermal End Loads | Guide Spacing | Thermal End Loads | Guide Spacing | Thermal End Loads | Guide Spacing | Thermal End Loads |
| In.  | Ft.                                 | Lbs.              | Ft.           | Lbs.              | Ft.           | Lbs.              | Ft.           | Lbs.              |
| 6    | 30.4                                | 1,447             | 25.5          | 1,910             | 22.8          | 2,198             | 21.3          | 2,312             |
| 8    | 39.6                                | 2,126             | 33.2          | 2,806             | 29.7          | 3,230             | 27.7          | 3,397             |
| 10   | 49.2                                | 2,681             | 41.2          | 3,537             | 36.9          | 4,071             | 34.4          | 4,282             |
| 12   | 59.3                                | 3,753             | 49.7          | 4,952             | 44.5          | 5,700             | 41.5          | 5,995             |
| 14   | 67.4                                | 4,736             | 56.5          | 6,249             | 50.5          | 7,192             | 47.1          | 7,566             |
| 16   | 76.8                                | 6,032             | 64.4          | 7,959             | 57.6          | 9,160             | 53.7          | 9,635             |

| NOTES   |
|---|
| The guides must be rigidly attached to the supporting structures so the pipe moves freely in the axial direction. |
| Spacing and end loads based on 75° F installation temperature   |
| To obtain contraction end loads for 6"-16" CERAM CORE pipe, multiply table values by 1.73.                        |

# CERAM CORE PIPING SYSTEM

## Maximum Support Span @75° (24°C)<sup>(1)</sup>

| Nominal Pipe Size |     | Specific Gravity 1.0 / Continuous Span |      |
|-------------------|-----|--|------|
| In                | mm  | Ft.                                    | m    |
| 6                 | 150 | 19.2                                   | 5.85 |
| 8                 | 200 | 21.3                                   | 6.50 |
| 10                | 250 | 22.8                                   | 6.94 |
| 12                | 300 | 24.9                                   | 7.58 |
| 14                | 350 | 26.4                                   | 8.05 |
| 16                | 400 | 28.1                                   | 8.56 |

## Support Span vs. Temperature

| Nominal Pipe Size |         | Adjustment Factor for Operating Temperature (°F) |     |     |     |     |     |
|-------------------|---------|--|-----|-----|-----|-----|-----|
| In                | mm      | 75   | 100 | 125 | 150 | 175 | 200 |
| 6-16              | 150-400 | 1.0  | .98 | .95 | .94 | .93 | .91 |

## Support Span vs. Specific Gravity

| Adjustment Factor | Specific Gravity of Liquid |      |     |     |      |     |
|-------------------|----------------------------|------|-----|-----|------|-----|
|                   | .75                        | .9   | 1.0 | 1.1 | 1.25 | 1.5 |
|                   | 1.05                       | 1.02 | 1.0 | .98 | .95  | .92 |

## Adjustment Factors for Various Spans With Unsupported Fitting at Change in Direction

| Span Type   | Factor |
|---|--------|
| a Continuous interior or fixed end spans                | 1.00   |
| b Second span from supported end or unsupported fitting | 0.80   |
| c+d Sum of unsupported spans at fitting                 | ≤0.75* |
| e Simple supported end span                             | 0.67   |

\*For example: If continuous support is 10 ft., c+d must not exceed 7.5 ft. (c=3 ft. and d=4.5 ft.) would satisfy this condition.

## Adjustment Factors for Various Spans With Supported Fitting at Change in Direction

| Span Type  | Factor |
|--|--------|
| a Continuous interior or fixed end spans                       | 1.00   |
| b Second span from simple supported end or unsupported fitting | 0.80   |
| e Simple supported end span                                    | 0.67   |

(1) Based on 1/2" (12.7 mm) deflection at mid-span.

Refer to Bulletin No. E5000 for information on anchors.  
Refer to Bulletin No. F6460 for installation instructions.



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